JPL SURP Strategic Topic Areas - 2007

Topic Area:	9. Large, Strong, Lightweight, Precise, Dynamically Stable, Deployable Structures
Champion(s):	Richard W. Capps – (360) 378-8539 [Richard.W.Capps@jpl.nasa.gov]

Large space structures are, literally, the basic building blocks of JPL's missions. Strong, lightweight, dimensionally precise, dynamically stable, deployable structures remain a fundamental enabling capability for space exploration.

The structural technologies of immediate interest to JPL combine to support precision metering of large optical or antenna elements with scale lengths of tens of meters and probably cryogenic temperatures, precision positioning of occulting mask apodizing shapes over scale lengths of many tens of meters, and virtual positioning of co-flying distributed aperture instruments such as optical interferometers with dimensional scales of hundreds of meters.

Success is measured by significant improvements relative to the state-of-the-art in strength to mass ratio, improved dynamic performance, and the degree to which predictive precision performance modeling matches real-world structural behavior (micro-precision linear performance).

Technologies and capabilities of interest include:

- Improvements in lightweight precision structural materials
  - Linear behavior (absence of microdynamic effects)
  - High strength, low density, dimensionally stable
  - Wide temperature range extending to cryogenic regimes

- Improvements in hinges, latches, and joints
  - Linear behavior
  - Reduced mass
  - Wide temperature range

- Improvements in passive and active dimensional control of rigid and virtual structures
  - In-flight metrology components
  - Low power, long life
  - Metrology and control algorithms
  - Pointing and tracking between cooperative virtual structure elements
  - Precision spacecraft constellations
  - Active or adaptive optical wavefront sensing and control

- Improvements in structural dynamics of both physical and virtual structures
  - Active and passive vibration damping
  - Efficient pointing and tracking

- Improvements in propulsion technologies for large structures
  - Precision positioning for formation flying